

In the Claims:

1-98. (canceled)

99. (Currently amended) A system for controlling and modifying ~~[[the]]~~ vibratory motion of at least one string of a stringed musical instrument comprising:

a) transducer means associated with at least one string for providing a sensing signal representative of ~~string-vibration~~ vibratory motion of the string and for applying a force to said at least one string in accordance with an actuating signal;

b) at least one motion controller associated with said transducer means and responsive to said sensing signal to form said actuating signal for selectively damping and/or exciting the vibratory motion of the string or selected harmonics thereof; and

c) user control means to provide ~~the musician with~~ control over the behavior of said at least one motion controller.

100. (Currently amended) The system of claim 99 wherein said transducer means ~~consists of~~ comprises at least one unitary sensing/actuating transducer arranged to produce during a first portion of a time frame ~~[[a]]~~ the sensing signal representative of string motion and to apply during a second portion of said time frame an actuating force to said at least one string in accordance with ~~[[an]]~~ the actuating signal; and

wherein said at least one motion controller is arranged to respond to said sensing signal during said first portion of said time frame and to provide said actuating signal during said second portion of said time frame for selectively controlling the vibratory motion of the string over a succession of said time frames.

101. (Currently amended) The system of claim 99 wherein said transducer means ~~is composed of~~ comprises at least one sensing transducer for providing ~~[[a]]~~ the sensing signal ~~representative of string-vibration~~ and at least one separate actuating transducer for applying a force to said at least one string in accordance with ~~[[an]]~~ the actuating signal; and

wherein said at least one motion controller ~~[[is]]~~ comprises an adaptive control system coupled to said sensing transducer and to said separate actuating transducer and

arranged to respond to said sensing signal and to provide and adaptively adjust the characteristics of said actuating signal to maintain control of said vibratory motion of the string.

102. (Currently amended) The system of claim 100 wherein said at least one unitary transducer comprises first and second unitary sensing/actuating transducers arranged in an orthogonal relationship relative to the string and wherein said motion controller is switched between the first and second unitary transducer at one-half the time frame rate the first and second unitary transducers each being arranged to sense and actuate separate orthogonal components of the vibratory motion ~~of a string vibrating~~ in more than one plane.

103. (Currently amended) The system of claim 99 including at least one secondary sensing transducer ~~(FIG. 2, 52a-e)~~ for providing a secondary sensing output signal in accordance with the vibratory motion of at least one string.

104. (Currently amended) The system of claim 99 further including a mixer for combining ~~various~~ signals of the system into a composite audio output signal.

105. (Currently amended) The system of claim 100 wherein the said motion controller is arranged to drive the transducer using a discontinuous pulse width modulator further having a pre-distorting element to correct ~~the a~~ non-linearity of said pulse width modulator.

106. (Currently amended) The system of claim 99 including an external input for supplying an external signal to modify the vibratory motion of ~~[[a]]~~ said string.

107. (Currently amended) The system of claim 99 wherein said user control means includes at least one control that is manually operable ~~by the musician~~ for control of system behavior.

108. (Currently amended) The system of claim 100 wherein said at least one motion controller is responsive to a reference control signal input prescriptive of string motion and wherein said user control means includes a supervisor to facilitate player control of system behavior, said supervisor being responsive to preselected player techniques involving selected characteristic features of **string vibratory** motion and supplying said reference control signals to said at least one motion controller.

109. (Currently amended) The system of claim 99 wherein said actuating signal **[[is]] comprises** a correction signal for reducing **[[the]]** deviation of the string's **vibratory** motion from a desired motion.

110. (Currently amended) The system of claim 108 wherein **vibratory** motion of the string undergoing a smooth changing of pitch **[[is]] comprises** one of the preselected player techniques.

111. (Currently amended) The system of claim 110 wherein the ~~supervisor/controller~~ **supervisor** is arranged to **cause the motion controller to** provide **[[an]] the** actuating signal that modifies the **vibratory** motion of the string in accordance with a measurement of vibrato.

112. (Currently amended) The system of claim 111 wherein said measurement is of the magnitude of pitch change due to vibrato and said modification to motion ~~consists of~~ **comprises** exciting and sustaining string vibration according to said magnitude of vibrato.

113. (Currently amended) The system of claim 110 wherein the ~~supervisor/controller~~ **supervisor** is arranged to **cause the motion controller to** provide **[[an]] the** actuating signal that modifies the **vibratory** motion of the string in accordance with a measurement of pitch change due to glissando.

114. (Currently amended) The system of claim 108 wherein the ~~supervisor/controller~~ supervisor is arranged to cause the motion controller to provide ~~[[an]]~~ the actuating signal that modifies the pitch of string vibration.

115. (Previously presented) The system of claim 114 wherein said pitch modification substantially corrects the pitch to conform to a standard pitch.

116. (Currently amended) The system of claim 108 wherein ~~[[the]]~~ amplitude of ~~vibratory motion~~ ~~string vibration is~~ comprises one of the preselected player techniques.

117. (Currently amended) The system of claim 116 wherein a string undergoing motion having amplitude above a threshold causes the ~~supervisor/controller~~ supervisor to cause the motion controller to provide an actuating signal to excite and modify the string's vibratory motion and a string undergoing vibratory motion having amplitude below a threshold causes the ~~supervisor/controller~~ supervisor to cause the motion controller to provide an actuating signal to damp the string's vibratory motion.

118. (Currently amended) The system of claim 117 wherein said threshold is dynamic and derived from an averaging of one or more string vibratory amplitudes.

119. (Currently amended) The system of claim 108 wherein a motion of the string creating a new note ~~[[is]]~~ comprises one of the preselected player techniques.

120. (Currently amended) The system of claim 119 wherein the ~~supervisor/controller~~ supervisor is configured cause the motion controller to modify the ~~vibration of~~ vibratory motion producing the most recent note played and to damp other string vibrations.

121. (Currently amended) The system of claim 108 wherein the vibratory motion of the string creating a new note having a given spectrum ~~[[is]]~~ comprises one of the preselected player techniques.

122. (Currently amended) The system of claim 108 wherein the vibratory motion of the string creating one or a series of new notes of specified pitch ~~[[is]]~~ comprises one of the preselected player techniques.

123. (Currently amended) The system of 122 having a user selectable mode wherein ~~[[the]]~~ occurrence of a preselected one or a series of new notes causes the supervisor to activate a corresponding instrument definition obtained from several stored alternative instrument definitions each instrument definition prescribing a separate behavior of the instrument.

124. (Previously presented) The system of claim 108 having a mode wherein sympathetic vibrations occurring on unplayed strings are damped.

125. (Currently amended) The system of claim 108 wherein the vibratory motion of the string being muted is one of the preselected player techniques.

126. (Previously presented) The system of claim 108 wherein the supervisor is further arranged to record, store, access, route and process data relating to the system.

127. (Previously presented) The system of claim 108 wherein the supervisor is provided with one or more external data connections whereby programs in the supervisor can be changed or replaced and/or for general data communications and/or for an auxiliary user-interface.

128. (Currently amended) The system of claim 108 wherein a portion of the system ~~is realized using~~ comprises analog electrical circuitry.

129. (Currently amended) The system of claim 101 wherein said at least one motion controller is responsive to a reference control signal input prescriptive of string vibratory motion and wherein said user control means includes a supervisor to facilitate

player control of system behavior, said supervisor being responsive to preselected player techniques involving selected characteristic features of string vibratory motion and supplying said reference control signal signals to said at least one motion controller.

130. (Currently amended) The system of claim 129 wherein a motion of the string undergoing a smooth variation of pitch due to vibrato is one of the preselected player techniques;

the ~~supervisor/controller~~ supervisor is arranged to cause the motion controller to provide ~~[[an]]~~ the actuating signal that modifies the vibratory motion of the string in accordance with a measurement of vibrato; and

wherein said measurement is of ~~[[the]]~~ magnitude of pitch change due to vibrato and said modification to vibratory motion ~~consists of~~ comprises exciting and sustaining string vibratory motion vibration according to said magnitude of vibrato.

131. (Currently amended) The system of claim 129 wherein the ~~supervisor/controller~~ supervisor is arranged to cause the motion controller to provide ~~[[an]]~~ the actuating signal that modifies ~~[[the]]~~ pitch of string vibration.

132. (Currently amended) The system of claim 129 wherein ~~[[the]]~~ an amplitude of string vibratory motion vibration ~~is~~ comprises one of the preselected player techniques; and

wherein a string undergoing vibratory motion having amplitude above a threshold causes the ~~supervisor/controller~~ supervisor to cause the motion controller to provide ~~[[an]]~~ the actuating signal to excite and modify the string's vibratory motion and a string undergoing vibratory motion having amplitude below a threshold causes the ~~supervisor/controller~~ supervisor to cause the motion controller to provide ~~[[an]]~~ the actuating signal to damp the string's vibratory motion.

133. (Currently amended) The system of claim 132 wherein said threshold is dynamic and derived from an averaging of one or more string vibratory amplitudes.

134. (Previously presented) The system of claim 129 having a mode wherein sympathetic vibrations occurring on unplayed strings are damped.

135. (Previously presented) The system of claim 129 wherein the supervisor is provided with one or more external data connections whereby programs in the supervisor can be changed or replaced and/or for general data communications and/or for an auxiliary user-interface.

136. (Previously presented) The system of claim 129 wherein the supervisor is further arranged to record, store, access, route and process data relating to the system.

137. (Currently amended) The system of claim 129 wherein a portion of the system ~~is realized using~~ comprises analog electrical circuitry.

138. (Currently amended) A method of recognizing preselected player techniques in playing a stringed musical instrument and utilizing such recognized player techniques as player commands to govern the operation of at least one motion control system function coupled to at least one string of said instrument comprising:

~~providing a transducer means arranged to produce~~ producing a sensing signal representative of the vibration of said at least one string and ~~to apply~~ applying a force to said string in accordance with an actuating signal;

~~providing a motion controller coupled to the transducer means;~~

electronically recognizing one or more preselected player techniques; and

controlling the said motion controller function in accordance with the recognized player techniques to apply ~~[[an]]~~ the actuating signal ~~to the transducer means~~ to modify the vibratory motion of said at least one string by selectively damping and/or exciting ~~[[the]]~~ harmonic components of said vibratory motion ~~according to the intentions of the player.~~

139. (Currently amended) The method of claim 138 wherein the step of recognizing preselected player techniques includes:

extracting feature signals from ~~the transducer output signals associated with the~~ sensed vibratory motion of at least one each string; and

routing the extracted feature signals according to their correspondence to one or more preselected player techniques; and

applying, as pre-specified functions of the types and measurements of the routed extracted feature signals, actuating signals ~~to at least one of said transducers~~ to modify the vibratory motion of said at least one string.

140. (Currently amended) The method of claim 139 wherein ~~the step of~~ routing the extracted feature signals includes providing a set of pattern matching rules representative of features of string vibratory motion associated with the preselected player techniques, testing the extracted feature signals against said rules, and sending specific test-selected feature signals to prescribed function processors to generate control signals to govern said at least one motion control system function.

141. (Currently amended) The method of claim 138 wherein the preselected player techniques include one or more techniques in the form of amplitude of string vibration, vibrato, glissando, muting, plucking a new note of a selected amplitude, ~~[[the]]~~ spectrum of ~~[[a]]~~ the new note, ~~[[the]]~~ spectra of ~~[[a]]~~ the new note, ~~[[the]]~~ harmonic balance of ~~[[a]]~~ the new note, and one or a series of new note pitches.

142. (Currently amended) The method of claim 138 wherein ~~said motion controller of said at least one motion control system includes~~ a reference signal input ~~whereby said motion controller~~ receives control signals prescriptive of vibratory motion for comparison against the actual string vibratory motion as provided by said sensing signal representative of string vibration ~~and generates~~ to generate actuating signals resulting from said comparison ~~that create forces emanating from the transducer~~ to compel and constrain said string vibratory motion towards ~~an intended~~ vibratory motion as prescribed by said reference signal.

143. (Previously presented) The method of claim 142 wherein said reference signal derives from an external signal input to the instrument.

144. (Currently amended) The method of claim 142 wherein said reference signal is a frequency domain representation of the prescribed vibratory motion and the ~~step of~~ comparison includes converting said sensing signal representative of string vibration to ~~[[a]]~~ the frequency domain representation, comparing the magnitudes of spectral components of said sensing signal against those of said reference signal and generating an error signal therefrom that controls a feedback filter, ~~(block 170 of FIGS. 3, 4 and 7)~~, that forms said actuating signals.

145. (Currently amended) The method of claim 142 including ~~providing a storage array storing an array of reference signals and further including converting selected selecting particular reference signals from within said array according to extracted feature signals for routing to said reference signal input. to indices for addressing the storage array to supply reference signals to said motion controller.~~

146. (Currently amended) The method of claim 139 including ~~providing a storage storing an~~ array of pre-specified command phrases and instrument definitions and having a player-selectable instrument redefinition mode wherein ~~[[the]]~~ occurrence of ~~[[a]]~~ said pre-specified command phrase ~~consisting of~~ comprising one or a sequence of notes causes the instrument definition to be changed accordingly.

147. (Currently amended) The method of claim 138 wherein in ~~[[the]]~~ a case of multiple unitary sensing/actuating transducers all sensing signals from the transducers occur during the same first time portion of a time frame and all actuating signals applied to the transducers occur during a same second time portion of said time frame.

148. (Currently amended) A system for modifying the vibratory motion of at least one string of a stringed instrument in response to a measurement of a smoothly varying pitch of said at least one string due to ~~[[the]]~~ player technique of vibrato comprising:

a) ~~at least one transducer~~ one or more transducers for providing a sensing output signal in accordance with the vibratory motion of at least one string and for ~~effecting a change in~~ changing string vibratory motion in accordance with an actuating signal;

b) a ~~supervisor~~ feature extracting function responsive to ~~the occurrence of~~ said smoothly varying pitch for generating a control signal from a measurement of pitch displacement about an average pitch thereof; and

c) at least one ~~controller and~~ drive amplifier responsive to said control signal for applying ~~[[an]]~~ the actuating signal to said at least one transducer ~~in proportion to said measurement~~ to excite or sustain the vibratory motion ~~vibration~~ of said at least one string in response to said smoothly varying pitch.

149. (Currently amended) A method of modifying the vibratory motion of a plurality of strings of a stringed instrument comprising:

a) measuring the amplitude of the vibratory motion of the strings;

b) producing a first effect upon a string's vibratory motion when the amplitude of the string undergoing motion exceeds a threshold value; and

c) producing a second effect upon ~~[[a]]~~ the string's vibratory motion when the amplitude of vibratory motion is below the threshold value, wherein the threshold value ~~is derived from an averaging~~ derives from a running average of one or more string vibratory amplitudes and wherein said first and second effects are different.

150. (New) The method of claim 149 where said first effect is to excite and sustain vibratory motion and said second effect is to damp vibratory motion.

151. (New) The system of claim 101 wherein said at least one sensing transducer is a bridge pickup transducer.

152. (New) The system of claim 151 wherein said bridge pickup transducer is of the piezoelectric type.

153. (New) The system of claim 129 wherein said reference control signal input establishes a target amplitude for string vibratory motion such that vibratory motion of amplitude less than the target amplitude is excited up to the target amplitude and vibratory motion of amplitude greater than the target amplitude is damped down to the target amplitude.